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Flank instability at Mount Etna: testing the sensitivity of forward models to the internal structure

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The deformation recorded at Mount Etna during the last 15 years clearly shows that there is an interplay between activity of magmatic sources and instability of the SE sector. In particular, the anomalous sliding of the SE flank can be triggered by summit or flank eruptions (e.g., 2002), but it is also observed during quiescent loading phases (e.g., 1993-1997). This deformation is usually modeled by sub-horizontal dislocation surfaces (embedded in an elastic half space) whose parameters are determined fitting the observed surface deformation. The purpose of this paper is to investigate whether models forced by a simple isotropic expansion source but taking into account the internal structure of Mount Etna are capable to focus a significant amount of horizontal deformation in the eastern flank. We perform computations based on the finite element method along a 2D cross section. The deformation models include both topography and a synthetic reconstruction of the internal layering constrained by geology, seismic tomography and experimental measurements of Etnean rocks. We study the sensitivity of the predicted surface displacement to variations of internal layers rheology and/or mechanical parameters. Our first results suggest that significant contributions to increase the deformation in the SE sector are due to plastic rheology of the clay layers and to asymmetrical distribution of elastic parameters related to the high velocity body underneath Mount Etna imaged by seismic tomography.

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